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THE IIOT HELPS PREDICT EQUIPMENT FAILURES AND MINIMIZE UNPLANNED DOWNTIME

The inclusion of IIoT on processing equipment provides the capability to diagnose issues in real time and allow problems to be remedied during scheduled downtime.

By John Olson, Wisconsin Oven

The Industrial Internet of Things (IIoT) is a popular buzzword these days. As a result, original equipment manufacturers (OEMs) would like to successfully launch IIoT in their business and offer a level of connectivity in their equipment. The inclusion of IIoT on processing equipment can bring increased uptime by predicting equipment failures, adding the capability to diagnose issues in real time with access to cloud data and allow problems to be remedied during scheduled downtime. Knowing that there are underlying maintenance or control issues that could cause an equipment shutdown can provide the foresight to order spare parts, schedule maintenance or even simply adjust the control settings and algorithms to prevent serious downtime. However, adding IIoT technology just for the sake of getting on the bandwagon may not deliver on the promises that IoT could bring to industrial equipment.

To understand how innovative OEMs are able deliver predictive failure and remote diagnostics, it is important to first understand the barriers that previously prevented this type of capability in equipment. In the past, there were many hurdles and limitations to recording and retrieving the information needed to diagnose equipment in the field. Retrieving data already on the machine required either sending personnel to the equipment, having the end user download the data or using a Virtual Private Network (VPN) to remotely access the data that would typically be stored on a PLC or data logging hardware or software. Getting the necessary

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information via these methods can be time consuming and frustrating. In addition, while VPN can provide access to a few individuals, it can create vulnerabilities in the end user and/or OEM network. For this reason, many companies prohibit an outside vendor or computer from gaining access via a traditional VPN.

The next hurdle was determining the type and amount of data that would be relevant and useful to monitoring the health of equipment in the field. The type of sensors, data, storage and/or connectivity of the controller or PLC has historically limited the amount of remote diagnosis that can be accomplished. It required the engineers and programmers to predict all of the necessary information and algorithms ahead of time that would be used to diagnose issues automatically or remotely. Sensors were expensive and could be unreliable, which made it difficult to add sensors and determine what information they could provide. This, in turn, limited the number of sensors being added to equipment. When this fact was combined with the limited storage capability of many industrial controls, it created an impenetrable wall that prevented innovation.

Along came supervisory control and data acquisition (SCADA), a system that allowed the centralization of control and information inside a processing plant. This gave the operator the ability to monitor and control the process internally. It was a great leap forward for engineers and technicians within the plant: They learned about their process and, due to the centralized level of control for their equipment, were able to coordinate the control of all of the equipment used in their process and collect data that allowed them to improve that same process. While SCADA enabled new cycles of innovation to improve how a plant and process were operated, it had its own limitations. SCADA recorded and displayed information that was pertinent to the process and only lent access to the individuals that used the equipment. Recorded data only provided insight into the process. Additionally, it was rare to have an engineer or technician working at the plant that could identify which information could be used to diagnose and predict future failures of the many different types of equipment in their plant. Equipment manufacturers typically could not gain access to this data or more relevant data on the machine itself, so they had no incentive to add sensors to the equipment unless it was needed for alarms or control.

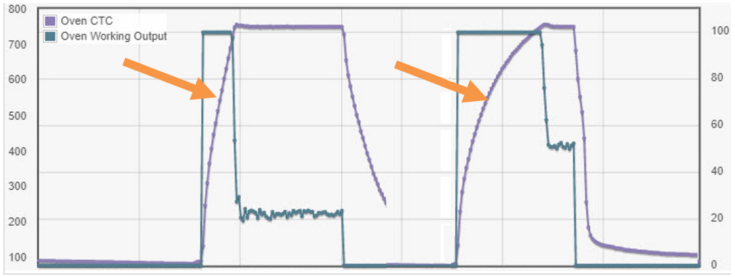
With the widespread access to IoT gateways and more secure cloud service providers (CSP) on the consumer and commercial markets, a new opportunity arose that enabled access to extremely valuable data. However, there were challenges in the different industrial communication protocols and the lack of connectivity on the plant floor. A few IoT providers recognized that distinction and a new branch, called the Industrial Internet of Things (IIoT), led to a new market for companies that could specialize in this new emerging technology. However, there were a few more hurdles to overcome. The first step was to move the plant SCADA system to the cloud. Doing so proved to be extremely successful in improving the plant process. However, this typically only provided benefits for the end user of the equipment and limited the success to companies who had internal experts on the equipment. This knowledge and innovation rarely propagated back to the engineers and technicians who manufactured and supported the equipment.

Some OEMs of industrial components and equipment began to offer more sensors and cloud access for end users. This was the next logical step in the path to remote diagnostics and the development of predictive failure algorithms. It seemed a quick and easy way to provide access to the information collected

and stored on the machine by moving that access to the cloud. No longer would end users be required to hard wire and navigate the myriad of communication protocols and the esoteric register lists for the data they wanted on the machine. Instead, OEMs could provide access to the cloud database and create dashboards with the KPIs that were important to the end users. But again, there still existed the barriers to real remote diagnostics and failure prediction.

Where innovative equipment manufacturers are succeeding is by adding this level of data acquisition and cloud access to each of its products and providing access to that data not only to the end user, but also to their own engineers and service technicians. By allowing their engineers to add new sensors on their own equipment in house and in equipment in the field, these OEMs created a new wave of innovation. Inexpensive sensors and data-rich components are being added to equipment so teams of talented engineers can now analyze the data. This creates a cycle to add more information, detect problems and failures, analyze the data recorded in the field to offer new levels of cost-effective remote diagnostics and to embed predictive failure algorithms into the equipment. By combining data from more intelligent components, engineers and technicians have access to a plethora of data and are no longer limited to adding expensive sensors and I/O modules for every new piece of data. For example, a new, relatively inexpensive vibration sensor can bring in hundreds of data points and built-in algorithms. Industrial PID controllers, PLCs and industrial control components can pass on thousands of different data points that may be useful for diagnostic purposes. The key to success is to continue to efficiently determine which sensors and what data can be used to create algorithms that are capable of predicting failure. This does take intimate knowledge of what a propagating failure looks like and requires combining that knowledge with the ability to create algorithms and adding them to the equipment. Equipment manufacturers successful in IIoT and predictive failure analysis encourage and enable coordination of their suppliers, engineers and service technicians.

One last crucial component is for these OEMs to collaborate with the end users of the equipment. At first glance, it is easy for a processor to fear giving access to equipment data to the OEM of that equipment. It may seem like a level of privacy is being lost; however, the OEM already knows how the equipment is supposed to operate in the process. In order for plant operators to be successful, they would have had to purchase equipment that is already designed specifically for that process or they would have had to convey that important information in the development of customized equipment. What actually happens by allowing IIoT and cloud data access to the OEM is that more privacy is achieved. The OEM can now only see its equipment operating. Previously, without this feature, a processor would have to allow OEM engineers or service technicians into the plant where they would see the proprietary processes, all the manufacturing equipment, the chemistry and recipes and the products being processed, which creates a privacy situation that may allow information to be communicated to competitors inadvertently. That said, allowing OEM access to IIoT data for their equipment ensures that processors have more control over the privacy of the process and products while increasing productivity and reducing downtime.



This graph, created in the dashboard, is an example of where an OEM service technician was going to be in the process plant. As noted, the heat up rate profile had changed significantly and the heat output for the temperature had increased greatly. This is a classic example of a progressive failure of a component. The equipment had not failed and was maintaining its process set point without warnings, but the data predicted failure. While preforming routine maintenance, the technician was able to correct the issue and avoid future downtime. Where it is feasible that the data can predict a new failure scenario, engineers use modern tools and algorithms to automatically detect and predict future failure.